Universal Library of Business and Economics Research Article

ISSN: 3064-9951 | Volume 3, Issue 3

Open Access | PP: 123-129

DOI: https://doi.org/10.70315/uloap.ulbec.2026.0303008

The Economics of Access to High-Technology Medical Care in Emerging Markets: Budget Procurement versus Concession

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Abstract

Regions with limited capital budgets face a recurring choice when a heavy radiotherapy unit must be acquired or replaced: a one-off budget purchase or a concession under which a private investor finances the equipment and recovers the outlay over a fixed term. This study compares the two schemes on primary documents from three projects that equipped public oncology centers in Kazan, Ulyanovsk, and Astana between 2014 and 2018 across seven parameters: budget load in the year of commissioning and in later years, bearer of capital cost, bearer of volume risk, ownership of the equipment, response to equipment failure, and financing of replacement. Cash flows of the Kazan concession, which combines a budget reimbursement of RUB 318.0 million spread over ten years with a per-case payment of 24.3 percent of the regional tariff, are reconstructed and discounted at four rates. The present value of public payments under the concession equals the value of a one-off purchase at a discount rate close to 10 percent, and the concession becomes cheaper at every tested rate once a service contract is added to the procurement scenario. The gain for the public side lies in risk transfer and in the timing of outlays, while the replacement cycle stays unresolved.

Keywords: *Public-Private Partnership, Concession, Radiotherapy, Capital Procurement, Risk Allocation, Emerging Markets, Health Financing, Russia, Kazakhstan.*

INTRODUCTION

On the estimates of 2024, radiotherapy remained the treatment modality with the widest gap between need and supply in middle-income countries. The 2024 population-based estimate, based on the IAEA Directory of Radiotherapy Centers, shows that the number of megavoltage machines per million population in upper-middle-income countries remains several times below that of high-income countries, and the gap widens when the workforce is included (Zhu et al., 2024). The second Lancet Oncology Commission on radiotherapy confirmed that the disparity identified in 2015 persists and named the availability of machines and of a trained workforce as the limiting factors (Abdel-Wahab et al., 2024). For a regional health ministry, the problem takes a concrete form: the letter of the Ministry of Health of the Ulyanovsk Region of April 25, 2016, reports two of four external beam units due for replacement under a ten-year service life and a waiting time for admission that would exceed two months if the two units failed.

A region can close such a gap in two ways. The first is a budget purchase under public procurement rules, where the region pays the full price in the year of acquisition, and every subsequent cost of service, repair, and replacement falls on the institution. The second is a concession under Federal Law No. 115-FZ, in which a private investor finances the equipment and the reconstruction of the treatment room, operates the technical side for a fixed term, and recovers the outlay through payments from the public side over that term. Both routes deliver the same machine to the same patients and differ in who pays when, who bears which risks, and what remains with the region at the end of the term. The legal construction of the concession and the reimbursement mechanism through a national program are treated in separate works.

The economics of public-private partnerships have a settled core. Private finance improves incentives when the concessionaire bears risks it can manage, yet it neither frees public funds nor expands the pool of viable projects, because the public side ultimately pays for the asset (Engel et al., 2022). Risk allocation determines whether a partnership creates value, and reviews in the field show how difficult it is to specify, monitor, and enforce (Mazher, 2025). A systematic review of 159 articles identified eight recurring

Citation: Kudinov Dmitrii Sergeevich, "The Economics of Access to High-Technology Medical Care in Emerging Markets: Budget Procurement versus Concession", Universal Library of Business and Economics, 2026; 3(3): 123-129. DOI: https://doi.org/10.70315/uloap.ulbec.2026.0303008.

risk factors, with resource and structure risks dominating the record of failures (Rybnicek et al., 2020). In health care, the evidence base is thinner, and a review of partnerships for primary care in low- and lower-middle-income countries retained 14 studies from 4,290 screened records (Dove et al., 2025). Work published after the documents studied here were drawn up confirms both the direction of the field and the gap. A panel analysis of 148 health care partnerships in 22 emerging economies over 2005 to 2022 found that partnerships improved financing and access relative to traditional procurement where governance quality and macroeconomic stability were present (Moro-Visconti, 2026), and a longitudinal efficiency study of 14 partnership hospitals in Türkiye over 2015 to 2023 traced performance differences to equipment and staffing inputs in the same way that the Kazan documents separate the technical side from the clinical side (Küçük & Özsoy, 2026). Studies that compare a purchase and a concession for a single heavy unit, with the price formula disclosed, are absent from the accessible literature. A scoping review of health system interventions for radiotherapy access searched the literature to June 2025 and found financing reforms in three of thirty-one included studies, with a single partnership case among them (Chen et al., 2026), so the gap remained open at the time of publication.

The research question is the following: under which characteristics of the region and the patient flow does a concession provide access to an expensive technology at lower cost or with greater reliability than a budget purchase, and what does the public side pay for the transfer of risk. The article provides a comparative matrix across seven parameters, a quantitative reading of the Kazan project's pricing formula, a third point of reference in the form of the status quo for patients treated abroad, and a set of applicability conditions.

The analysis is retrospective and documentary. The letters, the draft agreement, and the planning documents date from 2014 to 2016, the three centers were commissioned in 2017 and 2018, and the contractual term of the Kazan concession runs to 2026, so the publication coincides with the closing year of the term. No operational data on the centers after commissioning are used, and every quantitative statement below refers to planned or contractual values as they stood in the documents of those years. The comparison is set against the literature available at the time of publication, and the studies of 2025 and 2026 cited above show where the question stands now without revising the figures.

MATERIALS AND METHODS

The analysis rests on primary documents that set out the terms of three projects before the centers opened: Kazan, commissioned in 2017; Ulyanovsk, commissioned in 2018; and Astana, commissioned in 2018, of which only the Kazan project has a fully disclosed financing scheme. Table 1 lists them with their issuers and dates, and states what each contributes to the model.

Table 1. Documentary base of the study

Document	Issuer and date	Contribution to the analysis
Letter No. 09-01/9092 on the financing of the center modernization	Ministry of Health of the Republic of Tatarstan, September 7, 2016	Total of RUB 468.0 million, three sources, planned profit, budget schedule
Draft concession agreement for the facility at 29 Sibirsky Trakt, Kazan	Cabinet of Ministers of Tatarstan, Directive No. 3045-r, December 21, 2016	Minimum investment, price formula, risks, ownership, penalties
Letter No. 73-IOGV-08.01/1377 on equipping the oncology dispensary and minutes of March 15, 2016	Ministry of Health and Government of the Ulyanovsk Region, 2016	Fleet, service life, planning norm, waiting time, public side
Letter No. 01-1668/1-6 to the Prime Minister, Resolution No. 366 on the Oncology Care Program for 2012 to 2016, draft Concept for 2016 to 2019	National Scientific Medical Center, June 18, 2014, and Government of the Republic of Kazakhstan, 2012 to 2016	Machine capacity, guaranteed care including treatment abroad, cost abroad as cited
Internal model of a partnership project for radiotherapy in Russia, chapters 2 and 3	Equipment supplier, 2016	Roles, structure of investor costs, qualitative estimate of payback

All figures in these documents are planned or contractual, and none report actual patient volumes, downtime, or realized payments, so the results describe the economics of the schemes as designed. The documentary basis and the reading of the contract clauses are built on first-hand participation in structuring the three projects on the equipment supplier's side, which provides direct access to the sequence of drafts and the reasoning behind the price formula. The internal model of 2016 provides the composition of investor costs, and none of its price figures appear in the text. The comparative frame consists of the seven parameters set out in Table 2 and a convergence threshold, the volume at which the scheme covers the investor's operating costs.

The cash flows of the public side and the investor in the Kazan project are reconstructed from the September 7, 2016, letter and the draft agreement. A mirror flow is built for a

hypothetical budget purchase of the same unit for the same RUB 318.0 million in 2017, with a service contract starting in the third year after the manufacturer's warranty, at 5 percent and 10 percent of the equipment price per year. Both flows are discounted to 2016 at 5, 8, 10, and 12 percent, a range that brackets the Bank of Russia's key rate, which remained between 10 and 11 percent through 2016. Sensitivity to volume is tested at 60%, 80%, 100%, and 120% of the plan. Four assumptions hold throughout: the tariff for tier III radiotherapy is constant in real terms, clinical staff are paid by the hospital under both schemes, tax effects are outside the model, and currency risk rests with the investor because the contract is denominated in rubles.

RESULTS

The Ministry of Finance of Tatarstan agreed a total of RUB 468.0 million for 2016 to 2026 from three sources: RUB 318.0 million from the republic's budget, RUB 130.0 million from mandatory health insurance within the dispensary's planned assignment, and RUB 20.0 million from interterritorial settlements. The letter states the investor's planned profit as RUB 78.9 million, or 20 percent of total costs over the term. Two circuits carry these sums to the concessionaire, and Fig. 1 shows how they are composed.

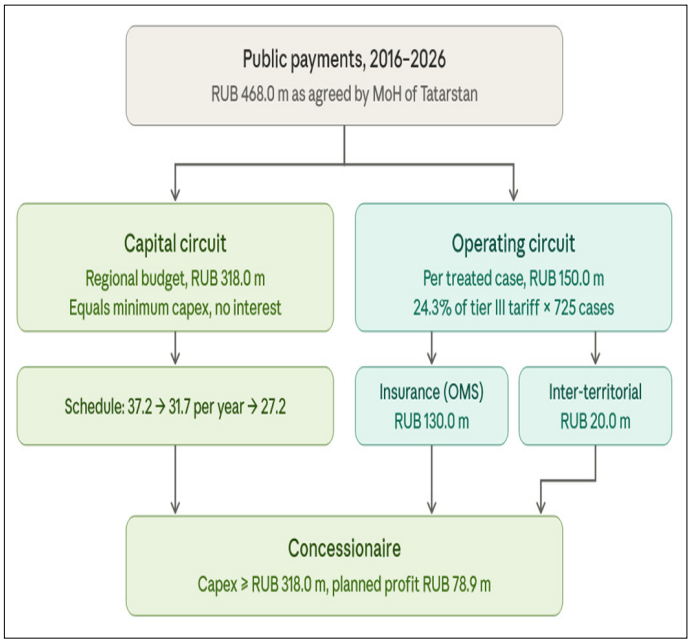

Fig. 1. Financing structure of the Kazan concession and the two payment circuits

The capital circuit is the budget reimbursement. The draft agreement sets the minimum investment at RUB 318.0 million and the reimbursement schedule at the same amount, so the region returns the nominal capital outlay in installments without an interest component. The letter of September 2016 and the draft of December 2016 spread the schedule in two versions, with a first installment of RUB 5.5 million in 2016 in the letter and RUB 37.2 million in 2017 in the draft, RUB 31.7 million in each intermediate year, and RUB 27.2 million in 2026 in both, and the draft schedule is used below. The operating circuit is the per-case payment: the dispensary pays the concessionaire 24.3 percent of the tariff for tier III radiotherapy for each treated patient, with a planned volume of 725 patients per year and a floor of RUB 13.0 million per year once the plan is delivered, which, together with the interterritorial share, comes to about RUB 15.0 million per year. The concessionaire pays no concession fee and no rent.

Several values follow from these terms. The payment per case is RUB 13.0 million divided by 725, close to RUB 17.9 thousand; dividing by 0.243 yields an implied tier III tariff of about RUB 73.8 thousand per course, of which the dispensary retains 75.7 percent. Total costs implied by the letter amount to RUB 468.0 million less RUB 78.9 million, or RUB 389.1 million. After subtracting the capital outlay, the investor's operating costs over ten years amount to RUB 71.1 million, about RUB 7.1 million per year. A sum of that size covers service, consumables, and insurance, and cannot cover clinical staff, who remain on the dispensary's payroll.

The two schemes place the same nominal capital sum on the budget in different years. Fig. 2 compares the annual public outlay under a one-off purchase with the outlay under the concession for 2017 to 2026, with both schemes starting in the year of commissioning.

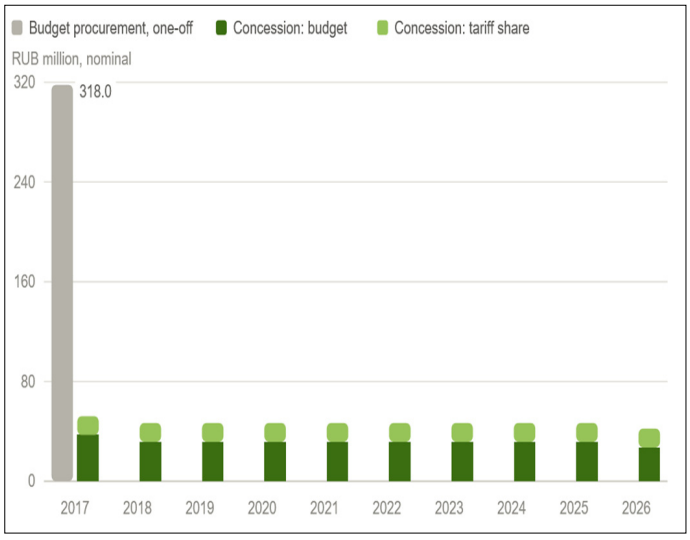

Fig. 2. Annual public outlay under budget procurement and under the concession, 2017 to 2026, RUB million

Under procurement, the region would spend RUB 318.0 million in 2017 and nothing afterward apart from service, which the figure omits, while under the concession, the region spends between RUB 27.2 million and RUB 37.2 million per year, and the dispensary transfers about RUB 15.0 million of tariff revenue each year.

The seven parameters separate the schemes on risk and ownership. Table 2 fills the matrix from the clauses of the draft agreement.

Table 2. Comparative matrix of budget procurement and concession across seven parameters

Parameter	Budget procurement	Concession, with clauses of the draft agreement
Budget load in the year of commissioning	Full price of the unit and of the treatment room	First installment of reimbursement, RUB 37.2 million, clause 46
Budget load in later years	Service contract and repairs from the budget of the institution	RUB 31.7 million per year plus 24.3 percent of the tariff per case, clauses 43 and 46
Bearer of capital cost	Region	Concessionaire, minimum RUB 318.0 million, clause 21
Bearer of volume risk	Region, through idle capacity	Concessionaire on the margin, since the floor of RUB 13.0 million requires 725 cases while the capital reimbursement is fixed
Ownership of the equipment	Institution from delivery	Excluded from the property of the concessionaire, clause 30, kept on its balance sheet, clause 31, returned to the grantor within ten days after the term, clause 33
Response to failure	Institution finances repair and bears downtime	Concessionaire performs current and capital repairs, clause 26, and bears the risk of accidental loss, clause 75
Replacement at the end of service life	New procurement cycle	Unit returns in year ten at the end of its service life, replacement returns to the region

Two risks remain with the public side under both schemes: tariff risk, since the per-case payment is tied to a tariff set annually by the same regional authorities, and the risk of revision of the reimbursement directive, for which clauses 81 to 83 of the draft allow renegotiation without a compensation mechanism.

Discounting changes the comparison. Table 3 reports the present value of public payments under the concession and under procurement at four discount rates, with all flows brought to 2016.

Table 3. Present value of public payments to 2016 under the two schemes, RUB million

Rate	Budget installments	Tariff share	Concession total	Purchase only	Purchase, service 5 percent	Purchase, service 10 percent
5 percent	247.3	115.8	363.1	302.9	396.1	489.3
8 percent	215.7	100.7	316.4	294.4	372.8	451.1
10 percent	198.0	92.2	290.2	289.1	359.2	429.3
12 percent	182.6	84.8	267.3	283.9	346.9	409.9

Without a service contract, the two schemes meet at a discount rate close to 10 percent, the indifference rate of the comparison. At 5 percent, the concession costs the region about RUB 60 million more in present value, and at 12 percent about RUB 17 million less. Once the service contract enters the procurement scenario at 5 percent of the equipment price per year, the concession is cheaper at every tested rate, and the margin widens beyond RUB 100 million at a service price of 10 percent. The result rests on planned figures and on the assumed service price and should be read as indicative.

The operating circuit exposes the investor to the patient flow. Fig. 3 plots the annual payment to the concessionaire against the number of treated cases, together with the contractual floor and the physical ceiling of one unit.

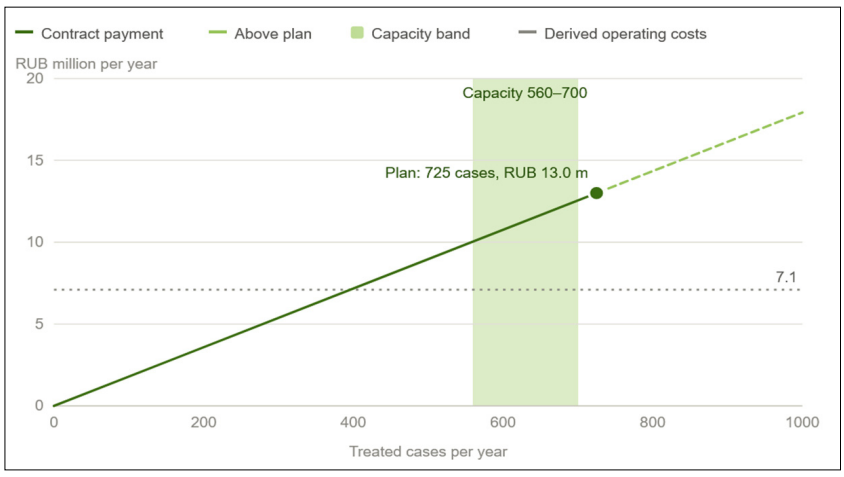

Fig. 3. Annual payment to the concessionaire as a function of patient volume, with the contractual floor and the capacity of one unit

The payment rises in a straight line at about RUB 17.9 thousand per case and reaches RUB 13.0 million at the planned 725 cases. Above the plan, the draft requires a supplementary agreement, and the flow cannot rise far: the letter of the National Scientific Medical Center of June 2014 puts the capacity of the same class of unit at 14,000 procedures per year, or 560 to 700 courses at 20 to 25 fractions per course, so the planned volume already sits at the ceiling of one unit. At 60 percent of the plan, the payment falls to about RUB 7.8 million; at 80 percent, to RUB 10.4 million; and at 120 percent, the machine's ceiling binds before the formula does. With operating costs of about RUB 7.1 million per year, the investor covers them at close to 400 cases. The capital reimbursement does not depend on volume, so the investor's capital is protected, and only the return on it is at risk.

The draft returns the equipment to the grantor within ten days after the end of the term. By that time, the unit will be 10 years old, which the Ulyanovsk letter treats as the standard service life for this class of equipment, so the residual value of the transferred asset will be low, and the region faces the replacement decision in 2027 in the same form as in 2016. The concession defers the replacement cycle by 10 years, and the draft provides no extension of the replacement cycle.

A third point of reference is the situation in which the region acquires nothing, and patients travel abroad. The letter of June 2014 to the Prime Minister of Kazakhstan cites an average cost of treatment in Europe between 500 and 1,200 euros without specifying the unit, and the magnitude suggests the price of a single fraction. The draft Concept for 2016 to 2019 states that treating one patient abroad costs the state between 150,000 and 250,000 US dollars and provides no justification for the figure. Against them, the implied tier III tariff of about RUB 73.8 thousand per course, close to 1,000 euros at the 2016 exchange rate, equals the cited price of a single fraction in Europe. The program approved by Government Resolution No. 366 of March 29, 2012, guaranteed oncology care, including treatment abroad, so the fiscal exposure of the status quo was a recognized line item before the Astana project began, and the 33,177 new patients with malignant neoplasms registered in Kazakhstan in 2022 (Turmakhanbetov et al., 2024) show the scale of the domestic flow.

DISCUSSION

The Kazan documents show what a region buys with a concession of this design. It buys an installment plan for the nominal capital sum without an explicit interest charge, and it buys the transfer of service, repair, and insurance risk to a specialist party. The price of the transfer is the 24.3 percent tariff that the institution collects from every treated patient. The finding aligns with the general result that private finance changes the timing of public outlays and the risk bearer, without lowering the total amount the public side pays (Engel et al., 2022).

The full cost of access exceeds RUB 468.0 million because clinical staff remain on the dispensary's payroll. Capital cost, dependence on the supplier for service, and workforce are the three obstacles that recur in accounts of modern radiotherapy adoption in middle-income countries (Maitre et al., 2022), and physicians and medical physicists are the scarcest of these resources (Zhu et al., 2024). The concession leaves the staff costs with the public side in full, and this allocation is the condition under which the operating circuit converges at all.

The zero concession fee and the absence of rent matter for convergence, since at a payment of RUB 13.0 million per year, any rent or fee would consume the investor's margin and push the break-even volume toward the capacity ceiling. Resource risks such as insufficient cost estimates and revenues that fail to materialize dominate the record of partnership failures (Rybnicek et al., 2020), and the small operating circuit keeps that exposure within reach of the investor.

One risk has no bearer in the draft. The dispensary that pays the per-case share reports to the same ministry that approves the reimbursement schedule and the tariff agreement, so the public side carries tariff and budget risk. Governance reviews of health partnerships in lower-income settings identify transparency in resource allocation and monitoring as the domains in which partnerships most often fail (Dove et al., 2025).

The design sits between two familiar instruments: it resembles pay-per-use arrangements in that the investor is paid per case, and it resembles a lease in that the capital sum returns in fixed installments. Comparative work on medical equipment procurement in eight countries shows that value-based procurement frameworks weigh service and life-cycle costs alongside the purchase price (Rahmani et al., 2022), and that the Kazan concession bundles life-cycle costs into a single contract. Such arrangements are effective when the public partner has the capacity to specify and monitor the contract (Liu et al., 2023). Recent guidance on radiotherapy scale-up makes the same point from the clinical side: predictable budgets for service contracts and parts matter as much as the initial capital purchase, and financing arrangements including partnerships still lack rigorous assessment (Chen et al., 2026). The concession is preferable when the cost of public capital exceeds the indifference rate, the capital budget for the year is constrained, patient flow is stable and close to the capacity of a single unit, a per-case tariff is approved and indexed, and the institution can staff the unit. Procurement is preferable where capital is cheap, the flow is small or unstable, no per-case share can be separated from the tariff, or a centralized service organization exists.

The analysis has limits that follow from its data. All figures are planned or contractual, and the concession agreement is a draft of December 2016. One of the three projects has a fully disclosed financing scheme, and the service price under

procurement is assumed to fall within a range. Future work should collect actual utilization data for the three centers from 2017 to 2024 and model an extension scenario that includes the replacement of the unit.

CONCLUSION

The comparison of a budget purchase and a concession on the primary documents of the Kazan project answers the research question. The concession provides access to a heavy radiotherapy unit at a present value of public payments equal to the value of a one-off purchase at a discount rate close to 10 percent, and it becomes the cheaper route at every tested rate once the service contract required for a purchase is counted. The gain for the region lies in the timing of outlays and in the transfer of service, repair, and insurance risk, and of the margin-related part of volume risk, to the investor, and the price of that transfer is the share of the tariff that leaves the institution for each treated patient.

Two features limit the design. Tariff and budget risk remain with the public side, and the unit returns to the region at the end of its service life, so the replacement decision recurs in the same form ten years later. A concession of this type suits a region with a constrained capital budget, a stable patient flow near the capacity of one unit, an indexed per-case tariff, and an institution able to staff the unit. Where capital is cheap and a service organization exists, procurement remains the simpler instrument. The findings rest on the documents of 2014 to 2016 for projects commissioned in 2017 and 2018 and describe the schemes as designed, so they read as a retrospective account of a contractual term that closes in 2026. The literature of 2025 and 2026 cited in the introduction shows that the choice between purchase and partnership remains open in emerging economies, which gives the documented case its continued relevance.

Conflict of Interest

During the period covered by the reference case, the author held a position at the company-manufacturer, including responsibility for developing the company's product launch strategy in emerging markets. This explains an access to the project management and other relevant documentation underlying the case and also introduces potential bias in the estimates. Three measures were taken to mitigate this bias. Numerical statements about market conditions and clinical outcomes are based on independent published sources, while indicators retrieved from internal design documentation are labeled in the text as estimates and program parameters and are not presented as established facts. Trademarks have been replaced with generic terms. Planned and contractual project indicators are separated from established facts and are not presented as results. The author did not receive any funding for the preparation of this article.

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